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10/632,873	08/01/2003	Yunsang Kim	APPM7354	4644

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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 12/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/632,873

Applicant(s)

KIM ET AL.

Examiner

Patricia A. George

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 12 January 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 14-20 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3, 7, 8 and 13 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-6 and 9-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 11/02/2006.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Response to Arguments*

Applicant's arguments filed 10/02/2006 have been fully considered but they are not persuasive. With respect to applicants' remarks, on page 6, that prior art of Hans fails to teach each of the claimed elements, examiner disagree. Applicants further argue that the reference of Hans teaches merely a method for stripping or removing etch residues (page 6), not a plasma etch process for selectivity (page 7). In response, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Hans clearly teaches a plasma etching (selective removal is selective etching) process for selectively etching a layer of low-k dielectric material, see rejection below. As to the selective removal of a layer of low-K dielectric material, it is well known in the art that selective plasma etching the surface of a substrate will remove a layer of the surface material (i.e. it is inherent to the process). The premise for selective etching: one material is removed at one etch rate while another supporting or exposed layer is removed at the same or another rate.

In addition, applicants argue (page 7) that the reference of Hans fails to teach a nitrogen containing gas (as in claim 1), or that it specifically is N<sub>2</sub>, (as in claims 2 and 5). Although applicants state that the reference of Hans includes nitrogen in a gas mixture is an element in a hydrogen bearing gas, not a separate gas in a gas mixture in addition to hydrogen, the reference of Hans clearly recites the use of nitrogen (i.e. N<sub>2</sub>)

Art Unit: 1765

and NF (see col. 3), both nitrogen-containing. Applicant does not present a negative limitation which would exclude the use of nitrogen in a mixture with hydrogen, therefore applicants' argument is not commensurate with the scope of the claimed language.

In response to applicant's argument, on page 8, that the combinations of Hans and Zhang, and Hans and Collins, fails to establish prima facie because the references of Zhang and Collins do not teach the limitations of the independent claim (1), the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Examiner has provided ample motivation for making the discussed combinations. The prior art rejection of 7/3/2006, stands below.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4, 5, 6, 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Han et al. (US 6,281,135).

Han et al. disclosed a process for selectively remove (i.e. selectively etching) charged particles from low-k dielectric (i.e. dielectric constant less than 4) (see the abstract) by plasma (ab.) etching with: a fluorine rich gas such as CF<sub>4</sub> (col.3, lines 44-50); nitrogen (i.e. N<sub>2</sub> - see col.3, line 61); and a hydrogen-rich hydrofluoropcarbon gas is selected from the group consisting of C<sub>sub.x</sub> H<sub>sub.y</sub> F<sub>sub.z</sub> wherein x ranges from 1 to 4, y ranges from 0 to 9 and z ranges from 1 to 10, which encompasses the range claimed by applicants. Han et al teaches the low-k dielectric material is situated into a plasma etch chamber, where it is plasma etched (col.3, lines 20-40).

Hans teaches use of the etching gas mixture further comprises an inert gas selected from the group consisting of argon, and helium, as in claim 12 (col.7, lines 25-30).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. (US 6,281,135 of Aug. 5, 1999), as applied to claims 1-2, 4, 5, 6, 12 above, and further in view of Zhang et al. (6,291,357)

Han is silent as to the configuration of the apparatus used for the selective etch, as applicants' limitations of claim 9: capacitively coupled RF such that a substantial DC bias exists between pedestal and plasma; and claim 10: applying bias to the pedestal, source power to the top electrode; and the source power having a greater frequency.

As to claim 9, Zhang et al. teaches the apparatus used to etch is capacitively coupled RF (col.8, line 9-10 then ) such that a substantial DC bias exists between pedestal and plasma (see figure 6 and summary section), as in claim 9.

As to claim 10, Zhang teaches applying bias to the pedestal and source power to the top electrode (see fig. 6) where the source power at the electrode can have higher frequencies than the bias, because a range is provided (see columns 7 through 8, starting at line 54, ending at line 54).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of selective etching, as Han et al., to include the apparatus parameters, as Zhang, because Zhang teaches such a configuration will reduce variations in the etch rate; provide more predictable and uniform etched shapes, which is desirable for manufacturing (see background).

***Claim Rejections - 35 USC § 103***

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. (US 6,281,135 of Aug. 5, 1999), as applied to claims 1-2, 4, 5, 6, 12 above, and further in view of Collins et al. (5888414).

Han is silent as to the configuration of the apparatus used for the selective etch, as applicants' limitations of claim 11: maintaining a plasma of etching gas mixture comprises applying a controlled rate (i.e. slowly) rotating magnetic field in the chamber.

Collins et al. (5888414) teaches maintaining a plasma of etching gas mixture comprises applying a controlled rate (i.e. slowly) rotating magnetic field in the chamber, as in claim 11.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include slowly rotating magnetic field in the chamber, as Collins et al., when etching, as Han et al., because Collins et al. teaches rotating the field reduces the non-uniformity gradient, a process improvement (col.2, lines 26-28).

***Allowable Subject Matter***

Claims 3, 7-8, and 13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Art Unit: 1765

As to claim 3, the closest prior art, Zhu et al. of 2002/0111036, which teaches selectively etching a low-k dielectric material at 3000 angstroms per minute, which is much less than the etch rate of higher than about 4000 angstroms per minute, as applicants' limitation.

As to claims 7, 8, and 13 no prior art was found that disclosed or suggested the ratio of volumetric flow rates as in applicants claims 7, 8, and 13.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571)272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.



Art Unit: 1765

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571)272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PAG  
11/06Patricia A George  
Examiner  
Art Unit 1765NADINE G. NORTON  
SUPERVISORY PATENT EXAMINER